

WHAT IS CLAIMED IS:

1. A two-layer imageable element comprising:
a substrate;
5 a top layer comprising a thermally imageable composition comprising: (a) a first thermally imageable composition comprising a first thermally sensitive supramolecular polymer which exhibits an increased solubility in an aqueous developer solution upon exposure to heat; said first thermally sensitive supramolecular polymer comprising: at least one
10 covalently bonded unit; and at least one thermally reversible non-covalently bonded unit, which includes a two or more centered H-bond within each non-covalently bonded unit or (b) a thermally imageable composition free of said first thermally sensitive supramolecular polymer; and
15 disposed between said substrate and said top layer, a bottom layer comprising a second thermally imageable composition comprising a second thermally sensitive supramolecular polymer which exhibits an increased solubility in an aqueous developer solution upon exposure to heat; said second thermally sensitive supramolecular polymer comprising:
20 at least one covalently bonded unit; and at least one thermally reversible non-covalently bonded unit, which includes a two or more centered H-bond within each said non-covalently bonded unit.
2. The imageable element of claim 1, wherein said two or more
25 centered H-bond in said top layer is a four centered H-bond.
3. The imageable element of claim 2, wherein said four-centered H-bond in said top layer comprises two isocytosine groups.

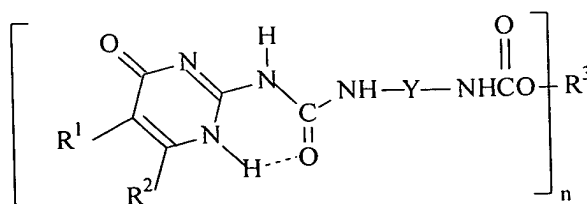
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4. The imageable element of claim 1, wherein said covalently bonded unit in said top layer is derived from a polyfunctional material that is soluble or dispersible in an aqueous developer solution.

5. The imageable element of claim 4, wherein said polyfunctional material is selected from the group consisting of: polyfunctional phenolic resin, acrylic resin, polyester resin, polyurethane resin, and a combination thereof.

6. The imageable element of claim 5, wherein said polyfunctional phenolic resin is selected from the group consisting of: phenol/cresol novolak, polyvinyl phenol polymer, vinyl phenol/hydrocarbyl acrylate copolymer, pyrogallol/acetone polymer and a mixture thereof.

7. The imageable element of claim 1, wherein said first thermally sensitive supramolecular polymer in said top layer comprises a supramolecular polymer derived from monomers represented by the formula:



wherein each R^1 and R^2 is independently selected from the group consisting of: hydrogen and hydrocarbyl;
wherein Y is a hydrocarbylene derived from a diisocyanate represented by the formula $\text{Y}(\text{NCO})_2$;

wherein R^3 is a phenolic residue derived from a polyfunctional phenolic resin represented by the formula $R^3(OH)_n$; and wherein n is at least 1.

5 8. The imageable element of claim 7, wherein said polyfunctional phenolic resin is selected from the group consisting of: phenol/cresol novolak, polyvinyl phenol polymer, vinyl phenol/hydrocarbyl acrylate copolymer, pyrogallol/acetone polymer and a mixture thereof.

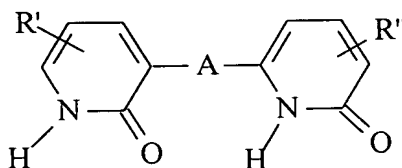
10 9. The imageable element of claim 7, wherein said diisocyanate is selected from the group consisting of: isophorone diisocyanate, methylene-bis-phenyl diisocyanate, toluene diisocyanate, hexamethylene diisocyanate, tetramethylxylylene diisocyanate, dimers thereof, adducts thereof with diols, and mixtures thereof.

15 10. The imageable element of claim 7, wherein n is 1, 2 or 3.

 11. The imageable element of claim 1, wherein said thermally reversible non-covalently bonded unit in said top layer includes a two-
20 centered H-bond, which comprises two 2-pyridone groups.

 12. The imageable element of claim 11, wherein said first thermally sensitive supramolecular polymer comprises a supramolecular polymer derived from monomers represented by the formula:

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wherein each R' and R'' is independently selected from the group consisting of: H, linear, branched or cyclic alkyl, aryl, aralkyl, alkaryl, substituted aryl, alkenyl, halogen, cyano, nitro, alkoxy, aryloxy, alkoxy carbonyl, amido, acyl, aminocarbonyl, carboxylic, sulfonic, imide, N-acyl sulfonamide and phenolic hydroxy with the proviso that at least one of said R' and R'' groups is selected from the group consisting of: carboxylic, sulfonic, imide, N-acyl sulfonamide and phenolic hydroxy; and wherein A is a bridging group selected from alkylene, arylene, aralkylene, alkarylene, substituted arylene, -O-, -S-, NR''', -CH=CH- and -C≡C-.

13. The imageable element of claim 1, wherein said thermally reversible non-covalently bonded unit in said top layer includes a three-centered H-bond, which comprises a cyclic imide group and a 2,6-diaminotriazine group.

14. The imageable element of claim 1, wherein said first thermally sensitive supramolecular polymer in said top layer comprises a maleimide/styrene copolymer associated with a 4-vinyl-2,6-diaminotriazine/ styrene copolymer, with the proviso that said copolymers comprise at least one base-soluble functional group selected from the group consisting of: carboxylic, sulfonic, imide, N-acyl sulfonamide and phenolic hydroxy.

15. The imageable element of claim 2, wherein said four centered H-bond comprises two N, N'-diacetyl-2,6-diaminotriazine units.

16. The imageable element of claim 15, wherein said four centered H-bond comprises two N, N'-diacetyl-2,6-diaminotriazine units.

17. The imageable element of claim 1, wherein said two or more centered H-bond in said bottom layer is a four centered H-bond.

18. The imageable element of claim 17, wherein said four-centered H-bond in said bottom layer comprises two isocytosine groups.

19. The imageable element of claim 1, wherein said covalently bonded unit in said bottom layer is derived from a polymer, which is soluble or dispersible in an aqueous developer.

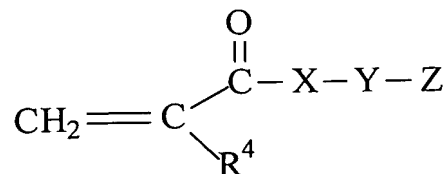
20. The imageable element of claim 19, wherein said polymer comprises at least one base soluble functional group.

21. The imageable element of claim 20, wherein said base soluble functional group is selected from the group consisting of: hydroxyl, carboxylic acid, sulfonic acid, phosphoric acid, imide, N-acyl sulfonamide and a combination thereof.

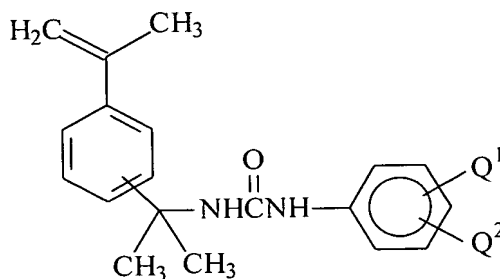
22. The imageable element of claim 21, wherein said hydroxyl group is an aromatic hydroxyl group.

23. The imageable element of claim 19, wherein said polymer is formed by polymerizing a monomer mixture comprising one or more of an ethylenically unsaturated monomer having a functional group selected from the group consisting of: hydroxyl, carboxylic acid, sulfonic acid, phosphoric acid and a combination thereof.

24. The imageable element of claim 23, wherein said ethylenically unsaturated monomer is selected from the group consisting of compounds represented by the formula:



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and a mixture thereof;

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wherein:

each Q^1 and Q^2 is independently selected from the group consisting of: hydroxyl and carboxylic acid groups;

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R^4 is selected from the group consisting of: hydrogen, linear, branched or cyclic alkyl of 1 to 22 carbon atoms, linear, branched or cyclic substituted alkyl of 1 to 22 carbon atoms, aryl of 6 to 24 carbon atoms and substituted aryl of 6 to 24 atoms, wherein said substituent is selected from the group consisting of: alkyl, aryl, halogen, keto, ester, alkoxy and cyano;

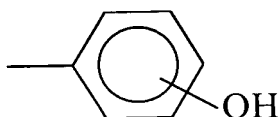
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X is selected from the group consisting of: O, S and NR^5 wherein R^5 is selected from the group consisting of: hydrogen, linear, branched or cyclic alkyl of 1 to 22 carbon atoms, linear, branched or cyclic substituted alkyl of 1 to 22 carbon atoms, aryl of 6 to 24 carbon atoms and substituted

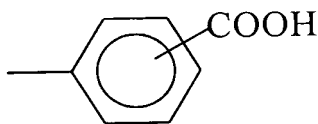
aryl of 6 to 24 atoms, wherein the substituent is selected from the group consisting of: alkyl, aryl, halogen, keto, ester, alkoxy and cyano;

Y is selected from the group consisting of: linear, branched or cyclic alkylene of 1-22 carbon atoms, alkyleneoxyalkylene, poly(alkyleneoxy) alkylene, alkylene-NHCON(R⁵)- and a bond; and

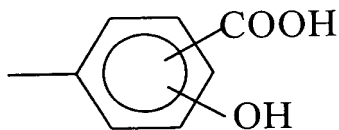
Z is selected from the group consisting of: hydrogen, hydroxyl, carboxylic acid and a group represented by the formula:



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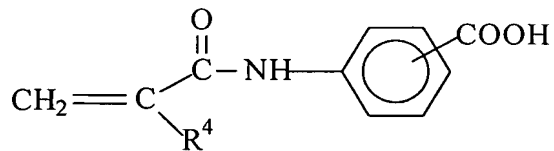


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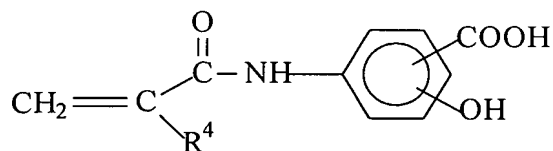
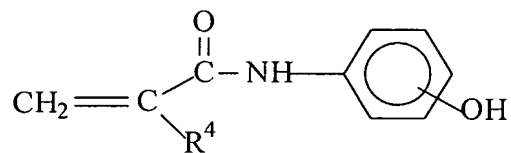


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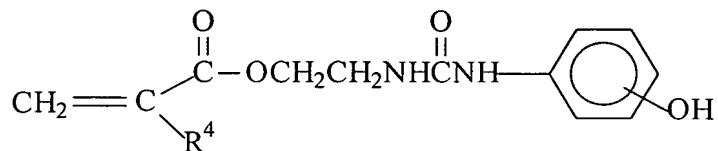
25. The imageable element of claim 24, wherein said ethylenically unsaturated monomer is selected from the group consisting of compounds represented by a the formula:



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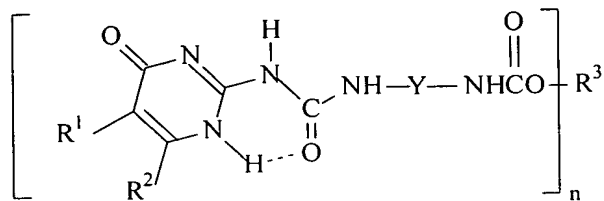
and a combination thereof.

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26. The imageable element of claim 23, wherein said monomer mixture further comprises an ethylenically unsaturated comonomer.

27. The imageable element of claim 26, wherein said ethylenically unsaturated comonomer is selected from the group consisting of: acrylic acid, methacrylic acid, acrylic acid ester, methacrylic acid ester, hydroxyethyl acrylate, hydroxyethyl methacrylate, hydroxypropyl acrylate, hydroxypropyl methacrylate, acrylamide, methacrylamide, N-methylacrylamide, N-methylmethacrylamide, acrylonitrile, methacrylonitrile, vinyl chloride, vinylidene chloride, vinyl acetate, vinyl ether, styrene, N-phenylmaleimide and a mixture thereof.

28. The imageable element of claim 1, wherein said bottom layer further comprises a polyfunctional phenolic resin represented by the formula:



wherein each R^1 and R^2 is independently selected from the group consisting of: hydrogen and hydrocarbyl;

wherein Y is a hydrocarbylene derived from a diisocyanate represented by the formula $Y(NCO)_2$;

wherein R^3 is a phenolic residue derived from a polyfunctional phenolic resin represented by the formula $R^3(OH)_n$; and

wherein n is at least 1.

29. The imageable element of claim 28, wherein said polyfunctional phenolic resin is selected from the group consisting of:

phenol/cresol novolak, polyvinyl phenol polymer, vinyl phenol/hydrocarbyl acrylate copolymer, pyrogallol/acetone polymer and a mixture thereof.

30. The imageable element of claim 1, further comprising a
5 photothermal converter material.

31. The imageable element of claim 1, wherein the thermally
imageable composition that is free of said first thermally sensitive
supramolecular polymer comprises a novolak resin and an infrared dye.
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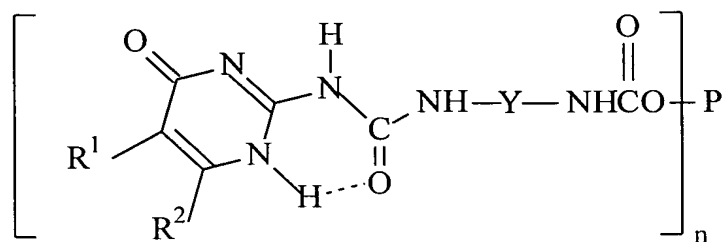
32. The imageable element of claim 1, wherein said first and
said second thermally sensitive supramolecular polymers are the same.

33. The imageable element of claim 1, wherein said first and
15 said second thermally sensitive supramolecular polymers are different
thermally sensitive supramolecular polymers.

34. A two-layer imageable element comprising:
a substrate;
20 a top layer comprising a first thermally imageable composition
comprising a first thermally sensitive supramolecular polymer which
exhibits an increased solubility in an aqueous developer solution upon (5)
exposure to heat; said first thermally sensitive supramolecular polymer
comprising: at least one covalently bonded unit; and at least one thermally
25 reversible non-covalently bonded unit, which includes a two or more
centered H-bond within each said non-covalently bonded unit; and
disposed between said substrate and said top layer, a bottom layer
comprising a second thermally imageable composition comprising a
second thermally sensitive supramolecular polymer which exhibits an
30 increased solubility in an aqueous developer solution upon exposure to
heat; said second thermally sensitive supramolecular polymer comprising:

at least one covalently bonded unit; and at least one thermally reversible non-covalently bonded unit, which includes a two or more centered H-bond within each said non-covalently bonded unit.

- 5 35. A thermally sensitive supramolecular polymer represented by the formula:



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wherein each R^1 and R^2 is independently selected from the group consisting of: hydrogen and hydrocarbyl;

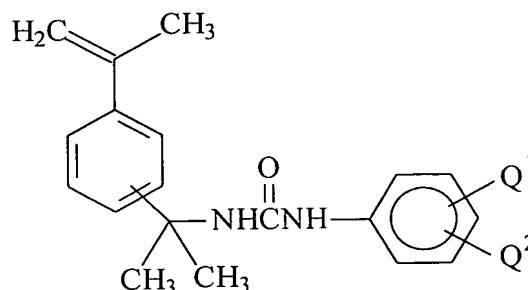
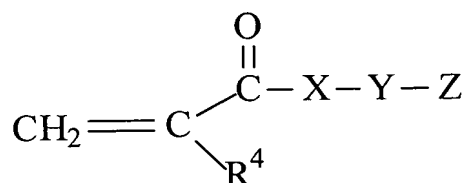
wherein Y is a hydrocarbylene derived from a diisocyanate represented by the formula $Y(NCO)_2$;

- 15 wherein P is a residue derived from a an n functional aqueous developer soluble or dispersible polymer represented by the formula $P(OH)_n$ wherein n is at least 1.

- 20 36. The supramolecular polymer of claim 35, wherein said n functional aqueous developer soluble or dispersible polymer $P(OH)_n$ is formed by polymerizing a monomer mixture comprising one or more of an ethylenically unsaturated monomer having a functional group selected from the group consisting of: hydroxyl, carboxylic acid, sulfonic acid, phosphoric acid and a combination thereof.

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37. The supramolecular polymer of claim 36, wherein said ethylenically unsaturated monomer is selected from the group consisting of compounds represented by the formula:



and a mixture thereof; wherein:

each Q^1 and Q^2 is independently selected from the group consisting of: hydroxyl and carboxylic acid groups;

R^4 is selected from the group consisting of: hydrogen, linear, branched or cyclic alkyl of 1 to 22 carbon atoms, linear, branched or cyclic substituted alkyl of 1 to 22 carbon atoms, aryl of 6 to 24 carbon atoms and substituted aryl of 6 to 24 atoms, wherein said substituent is selected from the group consisting of: alkyl, aryl, halogen, keto, ester, alkoxy and cyano;

X is selected from the group consisting of: O, S and NR^5 wherein

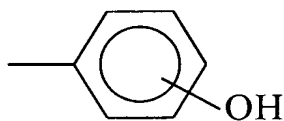
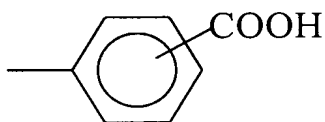
R^5 is selected from the group consisting of: hydrogen, linear, branched or

cyclic alkyl of 1 to 22 carbon atoms, linear, branched or cyclic substituted alkyl of 1 to 22 carbon atoms, aryl of 6 to 24 carbon atoms and substituted aryl of 6 to 24 atoms, wherein the substituent is selected from the group consisting of: alkyl, aryl, halogen, keto, ester, alkoxy and cyano;

- 5 Y is selected from the group consisting of: linear, branched or cyclic alkylene of 1-22 carbon atoms, alkyleneoxyalkylene, poly(alkyleneoxy) alkylene and a bond; and

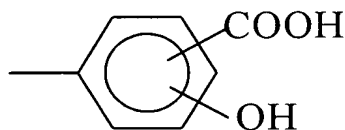
Z is selected from the group consisting of: hydrogen, hydroxyl, carboxylic acid, a group represented by the formula:

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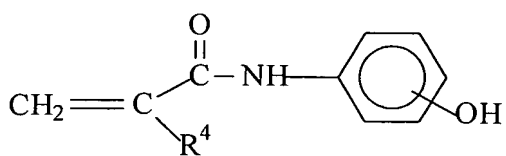
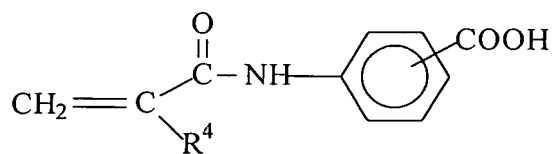
and



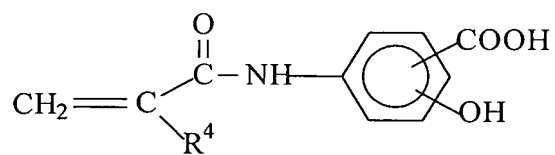
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38. The supramolecular polymer of claim 37, wherein said ethylenically unsaturated monomer is selected from the group consisting of compounds represented by a the formula:

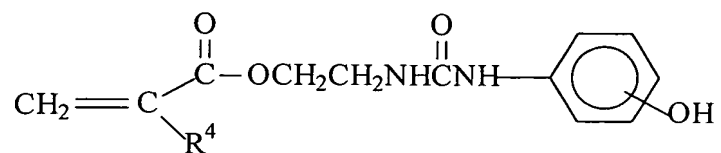
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and a combination thereof.

39. The supramolecular polymer of claim 38, wherein said monomer mixture further comprises an ethylenically unsaturated comonomer.

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40. The supramolecular polymer of claim 39, wherein said ethylenically unsaturated comonomer is selected from the group consisting of: acrylic acid, methacrylic acid, acrylic acid ester, methacrylic acid ester, hydroxyethyl acrylate, hydroxyethyl methacrylate, hydroxypropyl acrylate, hydroxypropyl methacrylate, acrylamide, methacrylamide, N-methylacrylamide, N-methylmethacrylamide, acrylonitrile, methacrylonitrile, vinyl chloride, vinylidene chloride, vinyl acetate, vinyl ether, styrene, N-phenylmaleimide and a mixture thereof.

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41. The supramolecular polymer of claim 35, wherein said diisocyanate is selected from the group consisting of: isophorone diisocyanate, methylene-bis-phenyl diisocyanate, toluene diisocyanate, hexamethylene diisocyanate, tetramethylxylene diisocyanate, dimers thereof, adducts thereof with diols, and mixtures thereof.

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42. A method of producing an imaged element comprising the steps of:

providing a two-layer imageable element comprising a substrate; a top layer comprising a thermally imageable composition comprising: (a) a first thermally imageable composition comprising a first thermally sensitive supramolecular polymer which exhibits an increased solubility in an aqueous developer solution upon exposure to heat; said first thermally sensitive supramolecular polymer comprising: at least one covalently bonded unit; and at least one thermally reversible non-covalently bonded unit, which includes a two or more centered H-bond within each said non-covalently bonded unit or (b) a thermally imageable composition free of

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said first thermally sensitive supramolecular polymer; and disposed between said substrate and said top layer, a bottom layer comprising a second thermally imageable composition comprising a second thermally sensitive supramolecular polymer which exhibits an increased solubility in an aqueous developer solution upon exposure to heat; said second thermally sensitive supramolecular polymer comprising: at least one covalently bonded unit; and at least one thermally reversible non-covalently bonded unit, which includes a two or more centered H-bond within each said non-covalently bonded unit;

exposing said two-layer imageable element to thermal radiation to produce imagewise exposed regions; and

contacting said exposed two-layer imageable element and a developer within a period of time after said exposing step to remove said exposed regions and thereby produce said imaged element.

43. The method of claim 42, wherein said thermally imageable element further comprises a photothermal converting material.

44. The method of claim 44, wherein said step of exposing said imageable element to thermal radiation is carried out using an infrared laser.

45. The method of claim 42, wherein said period of time is up to 1 hour.

46. The method of claim 42, wherein said thermal radiation has a pixel dwell time of not more than 100 μ s.